Small Bowel Injury From a Tangential Gunshot Wound Without Peritoneal Penetration: A Case Report

Homer C. Tien, MD, Teun W.G. van der Hurk, MD, M. Patricia Dunlop, MD, Bruce Kropelin, MD, Richard Nahouraii, MD, Anthony B. Battad, MD, MSc, and Teun van Egmond, MD

Gunshot wounds with transperitoneal trajectories are associated with a 98% incidence of significant intra-abdominal injuries and mandate exploratory laparotomy. However, protocols using triple-contrast computed tomography (CT) scanning or diagnostic laparoscopy are increasingly being used to evaluate bullet trajectories to determine the need for laparotomy based on peritoneal penetration. Patients can be treated nonoperatively as long as peritoneal penetration has been ruled out.

The studies recommending this approach have all been conducted within civilian trauma systems. Handguns cause the majority of gunshot wounds in this setting. Modern military rifles, however, have different wound ballistics than handguns. Civilian-based practice protocols for tangential gunshot wounds may not apply in the military setting.

CASE REPORT

A Role 3 multinational medical unit was established at Kandahar Airfield on February 7, 2006, in support of Operation Enduring Freedom, the U.S.-led War on Terror in Afghanistan. A 30-year-old Afghan man was brought to this facility after being shot by Afghan Security Forces. He arrived at the Kandahar Airfield multinational medical unit by helicopter approximately 8 hours after injury.

He was initially assessed and managed as per standard advanced trauma life support protocol. He was hemodynamically stable. He had an entrance wound in his anterior left flank and a large exit wound over his left paravertebral area (see Fig. 1). He had no peritoneal findings on abdominal examination, no blood on rectal examination, no gross hematuria, and no blood in his nasogastric aspirate. Plain film radiology of his chest, abdomen, and pelvis revealed no intrathoracic injury and no retained bullets in his torso. The patient did, however, have small bullet fragments in the left flank area, likely corresponding to the bullet tract. His trauma room ultrasound showed no fluid in either Morrison’s pouch, the splenorenal fossa, or the pelvis, and he had no pericardial fluid. It was thought that he had a tangential gunshot wound to the left flank with no peritoneal penetration. However, since we did not have CT or laparoscopic capability at the time, the patient was taken to the operating room for an exploratory laparotomy.

In the operating room, the patient was found to have no intraperitoneal blood or gastrointestinal contamination. There was a small hematoma in the left retroperitoneum. The overlying peritoneum, however, appeared intact. This hematoma was explored and revealed the bullet tract through the lateral aspect of the left psoas muscle and through the left paravertebral muscles. However, we also identified a full thickness injury to the small bowel (see Fig. 2). Contused tissue surrounded this small enterotomy, which was excised and repaired primarily.

DISCUSSION

Ballistic studies have shown that bullets produce both permanent and temporary cavities when fired through tissue. The size and contour of permanent cavities are the direct result of the size and path of the projectile as it travels through and crushes tissue. The temporary cavity, however, results from the hydrostatic force transmitted by the projectile, which stretches the surrounding tissue. Modern assault rifles impart significantly higher amounts of energy to tissue than handguns; as a result, the temporary cavity caused by these weapons can be up to 12 times the size of the permanent cavity.
Multiple studies in the civilian context have shown that tangential gunshot wounds to the abdomen can be managed conservatively if CT scanning or diagnostic laparoscopy have ruled out peritoneal penetration.2–5 No studies have demonstrated the safety of this approach for tangential gunshot wounds in the military setting.

In this report, we describe a case in which a patient suffered a full-thickness small bowel injury as a result of a gunshot wound from an AK-47, despite having a completely extraperitoneal bullet trajectory. We hypothesize that the bullet created a large temporary cavity as it passed through the retroperitoneum, which may have injured the adjacent small bowel segment without actually violating the peritoneal lining or cavity.

Therefore, we advocate caution in using civilian-based protocols for evaluating tangential gunshot wounds in the military setting.

REFERENCES

EDITORIAL COMMENT
The relationship between trauma care and war might be summarized by reference to the opening line of A Tale of Two Cities: “it was the best of times, it was the worst of times.”1 Although the meaning of the second portion of this phrase is obvious to all who have sustained or treated combat injuries, the first portion reminds us that important surgical advances have emerged from each recent major conflict. On the one hand, battlefield experiences have advanced civilian trauma care. During World War I, the survival advantage of celiotomy for penetrating abdominal trauma (previously recommended by the American Surgical Association in 1887) was realized.2 On the other hand, peacetime research has likewise informed battlefield trauma care. During the present conflict in Iraq and Afghanistan, for example, recent civilian innovations such as damage control surgery have been widely implemented.

This case report by Tien et al., however, indicates the need for caution in translating civilian experience to battlefield circumstances. As the authors point out, several recent studies have described successful nonoperative management of selected, stable patients with abdominal or flank gunshot wounds.
wounds, thus decreasing the rate of nontherapeutic celiotomy. Many of these studies have employed CT scans to rule out peritoneal penetration.3–9 Other studies have employed laparoscopy, which, however, does not permit reliable assessment of the entire abdomen and, in particular, the retroperitoneum.8

In the present case report, a hemodynamically stable patient without peritoneal signs had a single gunshot wound to the flank. In the absence of either a CT scan or laparoscopy, a celiotomy was performed. The small bowel was injured despite no evidence of peritoneal penetration. One can conclude on this experience, I think, that nothing has occurred to obviate the need for celiotomy for gunshot wounds to the abdomen or flank when adequate CT imaging is unavailable. This is particularly true given the greater destruction caused by high-velocity military bullets.

This is not to dispute the value of nonoperative management in selected military patients when CT scanning is available. One of the interesting and frankly unexpected lessons being learned from the current conflict is the value of CT scanning to assess penetrating injuries to the neck and torso. A negative CT scan has permitted successful nonoperative management of a large percentage of stable patients injured by improvised explosive devices (IEDs) in Iraq (McMullin N et al., unpublished data). CT scanning is particularly useful during mass casualty situations, when the hospital is confronted by the simultaneous arrival of dozens of patients with IED injuries. IEDs, however, generate predominantly low-velocity projectiles; thus, these results are not necessarily applicable to high-velocity gunshot wounds.

When resources are scarce and CT is unavailable, it may be reasonable in a mass casualty situation to triage stable and minimally symptomatic patients to the delayed category and to follow them clinically.10 This assumes, however, that an experienced clinician will be available to follow such patients serially. This assumption may not hold true in a military scenario. In conclusion, for gunshot wounds, I think it is usually best to adhere to the following strongly worded recommendation from the Emergency War Surgery handbook: “penetrating injuries below the nipples, above the symphysis pubis, and between the posterior axillary lines must be treated as injuries to the abdomen and mandate exploratory laparotomy.”11

Leopoldo C. Cancio, MD*
U.S. Army Institute of Surgical Research
Fort Sam, Houston, Texas

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